

REMARKS

Claims 5-7, 15-19, 23, 29-31 and 35-68 are pending in this application, with claims 5, 6, 15, 16, 35, 36, 39 and 40 being independent. Claims 5, 6, 15, 16, 35, 36, 39 and 40 have been amended, and new claims 55-68 have been added. Specifically, claims 5, 6, 35, 36, 39 and 40 have been amended to recite “forming a second amorphous semiconductor film on and in contact with the first amorphous semiconductor film so that a combined thickness of the first and second amorphous semiconductor films is within a range of 20-100 nm.” Claims 15 and 16 have been amended to recite “forming a second amorphous semiconductor film including silicon on the first amorphous semiconductor film so that a combined thickness of the first and second amorphous semiconductor films is within a range of 20-100 nm.” Support for this amendment and the new dependent claims may be found in the application at least at page 35, lines 6 to 13. Claims 15 and 16 have been further amended to recite “providing an element capable of promoting crystallization of silicon in contact with the first amorphous semiconductor film or the second amorphous semiconductor film after forming the second amorphous semiconductor film.” Support for this amendment may be found in the application at least at page 8, lines 20 to 21. No new matter has been added.

Applicants have amended the specification to correct a typographical error. Support for this amendment may be found in the application at least at page 27, lines 7-22.

Independent claims 15 and 16 have been rejected as failing to comply with the written description requirement. In particular, the Examiner contends that the application specification does not provide support for introducing a crystallization promoter into both the first and second layers after forming the second layer. Applicants have amended claims 15 and 16 to obviate this rejection.

Independent claims 5, 6, 15, 16, 35, 36, 39 and 40, along with their dependent claims 7, 17, 23, 29, 37, 38 and 41, have been rejected as being unpatentable over Noguchi (JP 04-168769) in view of Shimizu (U.S. Patent No. 5,753,541) and over Noguchi in view of Tsutsu (U.S. Patent No. 6,118,151).

Independent claims 5, 6, 15 and 39, as amended, each recite a method of manufacturing a semiconductor device including, among other features, “forming a first amorphous semiconductor film comprising/including silicon and germanium on the insulating surface/film wherein a concentration of the germanium is within a range of 0.1 atom% to 10 atom%” (emphasis added) and “forming a second amorphous semiconductor film ... so that a combined thickness of the first and second amorphous semiconductor films is within a range of 20-100 nm” (emphasis added). Independent claims 35, 36 and 40, as amended, each recite a method of manufacturing a semiconductor device including, among other features, “forming a first amorphous semiconductor film comprising silicon and germanium on the insulating surface/film wherein a concentration of the germanium is within a range of 0.1 atom% to 10 atom%” (emphasis added) and “forming a second amorphous semiconductor film ... so that a combined thickness of the first and second amorphous semiconductor films is within a range of 20-100 nm” (emphasis added).

Applicants request reconsideration and withdrawal of the rejections of claims 5, 6, 15, 35, 36, 39 and 40, and their dependent claims, because neither Noguchi, Shimizu, Tsutsu, nor any proper combination of the three describes or suggests forming a first amorphous film of silicon and germanium with a concentration of the germanium within a range of 0.1 atom% to 10 atom% and forming a second amorphous semiconductor film so that a combined thickness of the first and second amorphous semiconductor films is within a range of 20-100 nm.

The Examiner acknowledges that the combination of Noguchi and Shimizu and the combination Noguchi and Tsutsu do not explicitly disclose the feature of forming the recited amorphous film of silicon and germanium with a concentration of the germanium within a range of 0.1 atom% to 10 atom%. See page 5 of the Office Action. Nevertheless, the Examiner asserts that it would have been obvious to a person of ordinary skill in the art at the time of the invention to optimize, through routine experimentation of a result effective variable, the germanium concentration depicted in Fig. 2 of Noguchi, which depicts a broad range of germanium concentration, to obtain the claimed narrower germanium concentration range of 0.1 atom% to 10 atom%. See pages 5 and 6 of the Office Action.

MPEP § 2144.05 states “[g]enerally, differences in concentration or temperature will not support the patentability of subject matter encompassed by the prior art unless there is evidence indicating such concentration or temperature is critical. ‘[W]here the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation.’ *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955)” (emphasis added). Applicants refer the Examiner to page 35, lines 6 to 13 of the application, reproduced below, as evidence that the claimed concentration range of 0.1 atom% to 10 atom% and the claimed thickness range of 20-100 nm of the recited first and second amorphous semiconductor films are critical ranges that support patentability:

“such a crystalline semiconductor film which exhibits a high orientation with respect to the {101} plane is achieved not only by the addition of germanium at a concentration which is in the range of 0.1-10 atomic %, but also by the synergistic effect of the processing of adjusting the concentration of each element such as oxygen, nitrogen and carbon contained in the film to less than $1 \times 10^{19} / \text{cm}^3$ and the processing of setting the thickness of the crystalline semiconductor film within the range of 20-100 nm so that crystal growth predominates in a direction parallel to the substrate surface.”

As described in the application specification, the claimed concentration and thickness ranges are critical as they lead to a synergistic effect that results in a crystalline semiconductor film having a desirable high orientation with respect to the {101} plane. In contrast, neither Noguchi nor any of the other cited art describes or suggests the existence of this unexpected synergistic effect at these critical ranges that results in a crystalline film having an improved crystal orientation.

For at least these reasons, applicants request reconsideration and withdrawal of the rejections of claims 5, 6, 15, 35, 36, 39 and 40, and their dependent claims 7, 17, 23, 37, 38 and 41, because none of the cited art describes or suggests forming a first amorphous film of silicon and germanium with a concentration of the germanium within a range of 0.1 atom% to 10 atom% and forming a second amorphous semiconductor film so that a combined thickness of the first and second amorphous semiconductor films is within a range of 20-100 nm.

Independent claim 16, as amended, recites, among other features, “forming a first amorphous semiconductor film including silicon and an element having a larger atomic radius than silicon on an insulating surface wherein a concentration of said element is within a range of 0.1 atom% to 10 atom%” (emphasis added) and “forming a second amorphous semiconductor film ... so that a combined thickness of the first and second amorphous semiconductor films is

within a range of 20-100 nm" (emphasis added). For at least the reasons described above, applicants request reconsideration and withdrawal of the rejection of claim 16 and its dependent claim 29 because neither Noguchi, Shimizu, Tsutsu, nor any proper combination of the three describes or suggests forming a first amorphous semiconductor film including silicon and an element having a larger atomic radius than silicon with a concentration of the element within a range of 0.1 atom% to 10 atom% and forming a second amorphous semiconductor film so that a combined thickness of the first and second amorphous semiconductor films is within a range of 20-100 nm.

Claims 19, 31, 43 and 46, which depend from independent claims 15, 16, 39 and 40, have been rejected as being unpatentable over Noguchi in view of Shimizu and Zhang (U.S. Patent No. 5,578,520) and over Noguchi in view of Tsutsu and Zhang. Zhang does not remedy the failure of Noguchi, Shimizu, and Tsutsu to describe or suggest the subject matter of claims 15, 16, 39 and 40. Accordingly, applicants request reconsideration and withdrawal of the rejection of claims 19, 31, 43 and 46.

Independent claims 15 and 16 have been rejected as being unpatentable over Noguchi in view of Shimizu and Applicant's Admitted Prior Art (AAPA) and over Noguchi in view of Tsutsu and AAPA. Claims 17 and 29, which depend from claims 15 and 16, respectively, have been rejected as being unpatentable over Noguchi in view of Shimizu and AAPA and over Noguchi in view of Tsutsu and AAPA. AAPA does not remedy the failure of Noguchi, Shimizu and Tsutsu to describe or suggest the subject matter of claims 15 and 16. Accordingly, applicants request reconsideration and withdrawal of the rejection of claims 15, 16, 17 and 29.

Claims 18, 30, 42 and 45, which depend from claims 15, 16, 39 and 40, respectively, have been rejected as being unpatentable over Noguchi in view of Shimizu and Maekawa (U.S. Patent No. 6,066,547) and over Noguchi in view of Tsutsu and Maekawa. Claims 18 and 30, which depend from claims 15 and 16, respectively, have been rejected as being unpatentable over Noguchi in view of Shimizu, AAPA and Maekawa, and over Noguchi in view of Tsutsu, AAPA and Maekawa. Maekawa does not remedy the failure of Noguchi, Shimizu, Tsutsu and

AAPA to describe or suggest the subject matter of claims 15, 16, 39 and 40. Accordingly, applicants request reconsideration and withdrawal of the rejection of claims 18, 30, 42 and 45.

Claims 19 and 31, which depend from claims 15 and 16, respectively, have been rejected as being unpatentable over Shimizu in view of Noguchi and Zhang, over Shimizu in view of Noguchi, AAPA and Zhang, over Noguchi in view of Shimizu, AAPA and Zhang, and over Noguchi in view of Shimizu and Zhang. As noted above, Zhang does not remedy the failure of Shimizu, Noguchi, and AAPA to describe or suggest the subject matter of claims 15 and 16. Accordingly, for at least the reasons described above, applicants request reconsideration and withdrawal of the rejection of claims 19 and 31.

Claims 47-54, which depend from claims 5, 6, 15, 16, 35, 36, 39 and 40, have been rejected as being unpatentable over Noguchi in view of Shimizu and Kunii (JP 04-163910), over Noguchi in view of Shimizu and Cho (JP 11-340473), over Noguchi in view of Tsutsu and Kunii, and over Noguchi in view of Tsutsu and Cho. Kunii and Cho do not remedy the failure of Noguchi, Shimizu, and Tsutsu to describe or suggest the subject matter of claims 5, 6, 15, 16, 35, 36, 39 and 40. Accordingly, applicants request reconsideration and withdrawal of the rejection of claims 47-54.

Claims 49 and 50, which depend from claims 15 and 16, have been rejected as being unpatentable over Noguchi in view of Shimizu, AAPA and Kunii, over Noguchi in view of Shimizu, AAPA and Cho, over Noguchi in view of Tsutsu, AAPA and Kunii, and over Noguchi in view of Tsutsu, AAPA and Cho. As stated previously, AAPA, Cho, and Kunii do not remedy the failure of Noguchi, Shimizu, and Tsutsu to describe or suggest the subject matter of claims 15 and 16. Accordingly, applicants request reconsideration and withdrawal of the rejection of claims 49 and 50.

Independent claims 5, 6, 15, 16, 35, 36, 39 and 40, along with their dependent claims 7, 19, 31, 37, 38 and 41-54, have been rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1, 7, 50, 51, 59, 60, and 66 of U.S. Patent No. 6,482,684 ("the '684 patent") in view of Noguchi and AAPA.

The Examiner acknowledges that claims 1, 7, 50, 51, 59, 60, and 66 of the '684 patent do not recite the limitation "forming a first amorphous semiconductor film comprising silicon and germanium on the insulating surface/film wherein a concentration of the germanium is within a range of 0.1 atom% to 10 atom%" (emphasis added), as recited in claims 5, 6, 15, 35, 36, 39, and 40. The Examiner also apparently acknowledges that claims 1, 7, 50, 51, 59, 60 and 66 of the '684 patent do not recite the limitation "forming a first amorphous semiconductor film including silicon and an element having a larger atomic radius than silicon on an insulating surface wherein a concentration of said element is within a range of 0.1 atom% to 10 atom%" (emphasis added), as recited in claim 16. The Examiner, as before, relies upon the teachings of Noguchi to cure this deficiency through routine experimentation. For at least the reasons described above, however, this feature is patentable over Noguchi. Therefore, applicants request reconsideration and withdrawal of the rejection of claims 5, 6, 15, 16, 35, 36, 39 and 40, and their dependent claims 7, 19, 31, 37, 38 and 41-54.

Applicants do not acquiesce to the characterizations of the art. For brevity and to advance prosecution, however, applicants have not addressed all characterizations of the art, but reserve the right to do so in further prosecution of this or a subsequent application.

Applicants submit that all claims are in condition for allowance.

The fee in the amount of \$820 in payment for the excess claim fees (\$700) and for the Petition for One-Month Extension of Time fee (\$120) is being paid concurrently herewith on the Electronic Filing System (EFS) by way of Deposit Account authorization. Please apply any other charges or credits to Deposit Account No. 06-1050.

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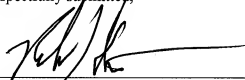
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